



VRIJE  
UNIVERSITEIT  
BRUSSEL

In cooperation with



GHENT  
UNIVERSITY

MASTER OF  
SCIENCE IN

# CHEM ISTRY

[www.vub.ac.be/chemistry](http://www.vub.ac.be/chemistry)

**120**  
**ECTS**

**2019-2020**

# WHY VUB?

## **VUB education creates strong individuals, critical minds and world citizens**

Vrije Universiteit Brussel (VUB) offers high-quality English-taught programmes, supported by outstanding research. Being a student at VUB means learning in an open atmosphere of tolerance and diversity, as well as growing into an independent and critical-thinking individual.

VUB is a comprehensive university and offers education on student-friendly campuses in the cosmopolitan city of Brussels. At VUB, lecturers and assistants are available and approachable to students. Faculty members are on hand to answer questions and teaching is often done in small groups to ensure close interaction and hands-on experience.

VUB is a dynamic and modern university with almost two centuries of history. We welcome more than 15.000 students, 21% of which are international students from more than 120 different countries.

## **The basis of our academic success**

Vrije Universiteit Brussel was founded on the principle of 'free inquiry' as formulated by the French mathematician and philosopher of science Henri Poincaré (1854-1912):

*"Thinking must never submit itself, neither to a dogma, nor to a party, nor to a passion, nor to an interest, nor to a preconceived idea, nor to anything whatsoever, except to the facts themselves, because for it to submit to anything else would be the end of its existence."*

Personal development, open-mindedness, a positive and critical attitude and a sense of responsibility are characteristics that you will encounter in everyone at the university: from professors and researchers to students and staff members. It lies at the basis of our academic success.





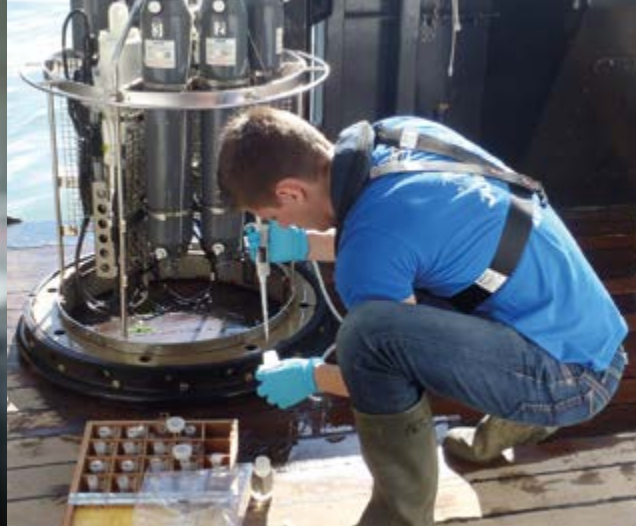


### **Solid theoretical background and hands-on experimental skills**

The Master in Chemistry is a two-year (120 ECTS) advanced study in chemistry. This MSc programme benefits from the expertise in the different research domains of both the Vrije Universiteit Brussel (VUB) and Ghent University (UGent). We offer a high-level scientific education that combines a solid theoretical background with real hands-on experimental skills and critical thinking. At the VUB, you work in modern, state-of-the-art laboratories and are part of a dynamic interuniversity research group. The close ties with the VUB's bio- and civil engineering departments also illustrate the multidisciplinary nature of the VUB's chemistry teaching. The experience you gain during your studies provides direct access to a PhD within the fields of organic, environmental or computational chemistry.

The Department of Chemistry highly values a personal approach, which manifests itself in lectures and extensive practical exercises in small groups. You can easily contact professors and teaching staff, who are available to coach you throughout your studies.

A wide choice of optional courses makes it possible to tailor your study programme to your specific interests. You are also encouraged to carry out an internship in Belgium or abroad.



# MASTER OF SCIENCE IN CHEMISTRY

## 3 profiles, 1 degree

You have a choice of 3 profiles: Research, Industry or Education. Whichever profile you choose, you graduate with the same Master's degree in Chemistry. During your studies you will acquire a solid formation as a chemist and can participate in high-level research. The VUB Master in Chemistry is clearly a top choice.

## Chemists wanted

Did you know Belgian companies are constantly searching for chemists? In Belgium, chemist is listed among the best-paying jobs. The Master in Chemistry prepares you for an interesting career in one of the most research-intensive and fast-growing sectors worldwide. Graduates work in a wide range of areas: in research, production, laboratories, sales and management. A number of chemists are employed in government labs, in food safety and research, production of drinking water, waste management and many other environmental aspects. In medical labs, hospitals and the pharmaceutical industry, there is also a growing need for chemists.

The Industry profile prepares you for a career in both technical and business aspects of chemistry (e.g. as Quality Assurance Officer, Technical Director, Project Manager, etc.). The Research profile opens the way to a scientific career, focused on research at universities (PhD research), institutes or even industry (e.g. as Pharmaceutical R&D manager, Compound Development Team Leader, Expert Analytical Development, etc.).

## Conquer the world

During your studies, you have the opportunity to broaden your horizons, by spending time abroad for courses, an internship or even your master's thesis. Within Europe, the Department of Chemistry has mobility agreements with several universities in Denmark, France, Ireland, Spain, Portugal and Poland. In addition, there are also multiple possibilities for an exchange outside of Europe. If you opt for the Industry profile, an industrial internship in Belgium or abroad is mandatory.

## International Solvay Institutes

Chemistry in Brussels goes back to 1913, when Ernest Solvay founded the International Institute for Chemistry. In 1970, the Solvay family in association with the Vrije Universiteit Brussel (VUB) and the Université Libre de Bruxelles (ULB) founded an independent body, the International Institutes for Physics and Chemistry, to continue this important quest for the advancement of scientific knowledge. Over the years, these institutes have remained symbols of scientific excellence. The Solvay Institute organises conferences and meetings that attract the most prominent chemists, and VUB's Chemistry Department is proud of this tradition.



TWO YEAR PROGRAMME	ECTS
<b>Master of Science in Chemistry</b>	
Chemical Process Technology	4
Molecular Physical Chemistry	5
Chemometrics	4
Advanced Organic Chemistry	5
Electrochemistry	4
Environmental Chemistry	3
Polymer Chemistry	5
Master's Thesis Chemistry	30
<b>Cluster (Choose a package of electives in)</b>	<b>30</b>
Molecular and Macromolecular Design	
Materials Chemistry	
Analysis and Characterisation	
Environmental Chemistry	
<b>Profile (Choose a package of electives in)</b>	<b>30</b>
Industry (e.g. courses in Business Aspects of Innovation in Materials, Chemical Process Development, Sustainability of Materials, ...)	
Research (e.g. courses in Homogenous catalysis, Peptidomimetic chemistry, Biogeochemistry, Quantum Chemical Methods, ...)	
Education (in Dutch, includes teaching degree)	
<b>Total</b>	<b>120</b>

#### 4 CLUSTERS

- **Molecular and Macromolecular Design** offers a thorough education in the design and synthesis of organic molecules and polymers, in which medicinal chemistry, computational chemistry and structural analysis feature prominently.
- **Materials Chemistry** focuses on the properties of materials, such as polymers, for example through surface analysis, X-rays and laser spectroscopy and computational chemistry.
- **Analysis and Characterisation** covers a whole range of analytical techniques, including new electrochemical methods, advanced chromatography and elemental and isotope analyses.
- **Environmental Chemistry** studies natural and disturbed processes in water, sediments and atmosphere. A variety of analytical techniques are used, and new sampling and measuring techniques are designed, tested, refined and optimised.

For the complete overview of all courses, go to [www.vub.ac.be/chemistry](http://www.vub.ac.be/chemistry)

The programme is subject to change. Check [www.vub.ac.be/chemistry](http://www.vub.ac.be/chemistry) for the latest information about the programme.

ECTS (European Credit Transfer System): 1 credit represents 25-30 hours of study activity.



# STUDENTS AS SCIENTISTS

The courses we offer are strongly embedded in the ongoing research programmes of both VUB and UGent. Through intensive collaboration with team members of the different research groups, you have the opportunity to develop and improve your scientific skills. VUB researchers enjoy strong connections both within and outside of Europe, through a wide range of research projects. This close connection to research also means our students are well prepared for a PhD-position in environmental, organic or computational chemistry.

## ORGANIC CHEMISTRY

Via the development of novel medicines, better chemical production processes or the discovery of new materials, progress in organic chemistry had - and still has - an enormous impact on our daily life and is responsible for a drastic rise in quality of life over the last century. However, major challenges still lie ahead in finding better and more environmentally friendly chemical processes, finding novel drugs to combat currently incurable diseases and to stop the rising resistance of microorganisms to antibiotics. In the Organic Chemistry (ORGC) research group at VUB, scientists are working on exactly these topics, seeking solutions for actual problems in materials and medicinal chemistry. The ORGC group has extensive expertise in the synthesis and development of peptides and peptidomimetics as novel bioactive compounds. New preparation methods are being developed for the synthesis of completely novel molecular architectures for use in polymer or medicinal chemistry. Therefore extensive research collaborations exist between the ORGC group and the pharmaceutical industry.

## GENERAL CHEMISTRY

In recent years, Quantum Chemistry (the application of quantum mechanics to chemical problems such as structure, stability and properties of molecules and their behavior during reactions) has made enormous progress via the so called Density Functional Theory (DFT). In this approach the electron density in each point is considered as the basic property of an atomic or molecular system from which all properties are derived.

The main research topic of the General Chemistry research group concerns both the development of concepts and the application of DFT on real-life chemical problems (conceptual and computational DFT). Fundamental research is performed on the development of DFT-based molecular charge distribution and reactivity descriptors and on the development and testing of related concepts. Applications are considered in organic and inorganic chemistry, in catalysis, biochemistry and materials chemistry, including both kinetic and thermodynamic aspects. Reactions in gas phase, solution and on surfaces are studied. Substrates and topics studied include catalytic and adsorption properties of zeolites, adsorption on silver surfaces, properties of organic functional groups and reactivity of radicals as well as fundamental properties of fullerenes, carbon nanotubes and graphene with applications to polymer nanocomposites and nanomaterials. This research is conducted in direct interaction with experimental research groups and industry.



## **ANALYTICAL, ENVIRONMENTAL AND GEOCHEMISTRY**

The Earth is marked by constant environmental changes in its evolution. The research group Analytical Environmental Geochemistry investigates both the ancient geological as well as the modern anthropogenic changes of the global Earth system using a series of biogeochemical tracers (elemental concentrations and isotopic ratios) in a wide range of substrates such as fossils, mussels, seawater, plankton, etc. The biogeochemical cycling of trace elements and organic pollutants in aquatic and terrestrial environments is investigated and human biomonitoring studies are performed to assess the impact of pollutants on human health. To address these topics, innovative analytical procedures are continuously being developed using the facilities available at the VUB and its partner universities. This analytical toolbox is then applied to various earth, environmental and pollution problems, often coupled with modeling.

## ADMISSION CRITERIA

Admission is based on the review of each application: proof of meeting academic and language requirements, personal motivation, etc.

### LANGUAGE REQUIREMENTS

Prospective students can provide proof of sufficient knowledge of English as language of instruction by meeting one of the following criteria:

- having successfully completed one of the following language proficiency tests:
  - TOEFL: minimum level 79 for the internet-based test (IBT)
  - IELTS: minimum level academic module 6.5
  - ITACE: minimum level B2
  - Cambridge Certificate of Advanced English (CAE), grade B
  - Cambridge Certificate of Proficiency in English (CPE), grade C
- having successfully completed at least one year of secondary education with English as language of instruction, or having successfully completed secondary school in a Belgian institution;
- having successfully completed programme units in higher education with a minimum of 54 ECTS-credits where English was the language of instruction.

For more details on admission requirements and application: [www.vub.ac.be/en/apply](http://www.vub.ac.be/en/apply)

For bachelors in science, applied science and life sciences admission will be evaluated based on academic records and skills. We require our students to have a solid background in organic, inorganic, analytical and quantum chemistry.

### Application deadline

Prospective students are advised to apply as soon as possible, even if they have not yet obtained their degree. Applications can only be submitted through our website [www.vub.ac.be/en/apply](http://www.vub.ac.be/en/apply)

- Students who require a visa (non-EU/EEA nationals) need to submit their application before **April 1st**.
- Students who do not require a visa must apply before **September 1st**.
- Note: if the proof of English proficiency or APS certificate is not ready before the deadline, you can always submit it later instead of missing the deadline.

### Tuition fees

All Flemish universities in Belgium are subsidised by the government, which results in relatively low tuition fees. The general tuition fee for our master programmes is €920/year. Some programmes have higher tuition fee for students with a non EU/EEA nationality. A detailed overview of the tuition fees can be found on:

[www.vub.ac.be/en/tuition-fees](http://www.vub.ac.be/en/tuition-fees)

### Contact

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